Desktop Virtualization in K–12 Schools: The Time Has Come

IDC GOVERNMENT INSIGHTS OPINION

Desktop virtualization is a strategic investment, solving many of the critical technology hurdles facing K–12 school districts today. It can alleviate problems around strategic direction and resource allocations by improving the end-user PC experience, reducing computer maintenance and support for IT staff, and decreasing the costs of services.

IDC Government Insights has noted accelerating deployments of virtualized desktops in K–12 schools across the globe. Catalysts for this change include significant reductions in overall PC spending and improved system performance among those educational organizations that have switched to virtualized PC desktop solutions. This success is real and measurable.

A confluence of factors has brought desktop virtualization to the forefront of investment decision making. These issues range from the technical (such as aging desktop machines and the need for upgrades to Windows 7 from XP or Vista) to industry forces at work (such as the desire to provision districtwide access to applications to physically separated schools and mobile teachers). But the overarching drivers of desktop virtualization are the educational goals that increasingly rely on student and teacher access to desktops and online educational materials.

For these and other reasons, desktop virtualization is a technology whose time has come for cost-conscious educational institutions. It follows on the heels of server virtualization, which has helped school districts realize significant cost savings by reducing the number of servers they maintain and by streamlining the overall physical and energy-related footprint of their datacenters. This success makes desktop virtualization the next logical target for many schools. The goal is ultimately to reduce costs, enhance IT service delivery and the end-user experience, and foster an improved learning environment.

IN THIS WHITE PAPER

This White Paper was written by IDC Government Insights and sponsored by VMware. It explores the potential advantages of using desktop virtualization for PCs rather than taking the traditional approach where every computer has its own operating system, resident applications, memory, processing power, and storage.

The methodology for this document is based on in-depth customer interviews and existing IDC desktop virtualization research. IDC Government Insights talked with IT managers in four school districts that have made a commitment to desktop virtualization using VMware. We asked them what worked, what proved to be a challenge, what they might do differently, and what specific benefits they've experienced. All interviewees said that they achieved significant productivity gains, reductions in costs, and improved services for end users. All are in the midst of expanding their initial commitment to desktop virtualization.

SITUATION OVERVIEW

Key Challenges for K–12 School Systems

PCs have become a requirement at K–12 schools, not only to graduate computer-literate students both also for teachers to access educational tools and applications and to manage school system administrative tasks. From mobile laptops that are shared across classrooms; to computers in labs, libraries and classes; to the office machines used by support staff and administrators, PCs can be found in every area of a modern primary or secondary school. But this widespread presence of PCs has become a double-edged sword at many facilities. While the wide array of computers has increased student, instructor, and staff access to information and computing resources, the presence of many machines has also become a management challenge for IT staffers. The following issues represent key challenges for IT:

- **Software and hardware maintenance.** Managing individual PCs (maintaining the machines, updating software, dealing with security issues, installing patches, and troubleshooting) has become more than a full-time job for current staffing levels of IT employees and contractors.

- **Student access and support for devices.** Many schools cited goals of having one machine per student and enabling anytime, anywhere student access to tools via their own devices for enhanced learning. Supporting applications on nonschool devices and providing a consistent experience for students pose significant resource challenges.

- **Budget constraints.** Aging hardware, the need to upgrade to Windows 7, and high costs per machine and associated software licenses combined with severe local budget constraints and concerns over school performance place institutions under a great deal of pressure.

Despite these challenges, students, teachers, and administrative staff need their computers. Most school districts must increase or refresh the numbers of machines at their schools, and desktop virtualization offers a significantly more efficient approach to how these machines are managed.

What Is Desktop Virtualization?

Virtualized desktops effectively separate a PC's desktop environment from the physical machine that's displaying and interacting with the environment. "Virtualization" of a desktop means that the person using the computer will experience a traditional PC look and feel while interacting with the computer, but the individual is actually interacting with a client machine. The desktop is a window that loads from a remote central server. The operating system, programs, applications, storage, backup, data, and processing are all handled by a server that resides in the datacenter (see Figure 1).

Desktop Virtualization
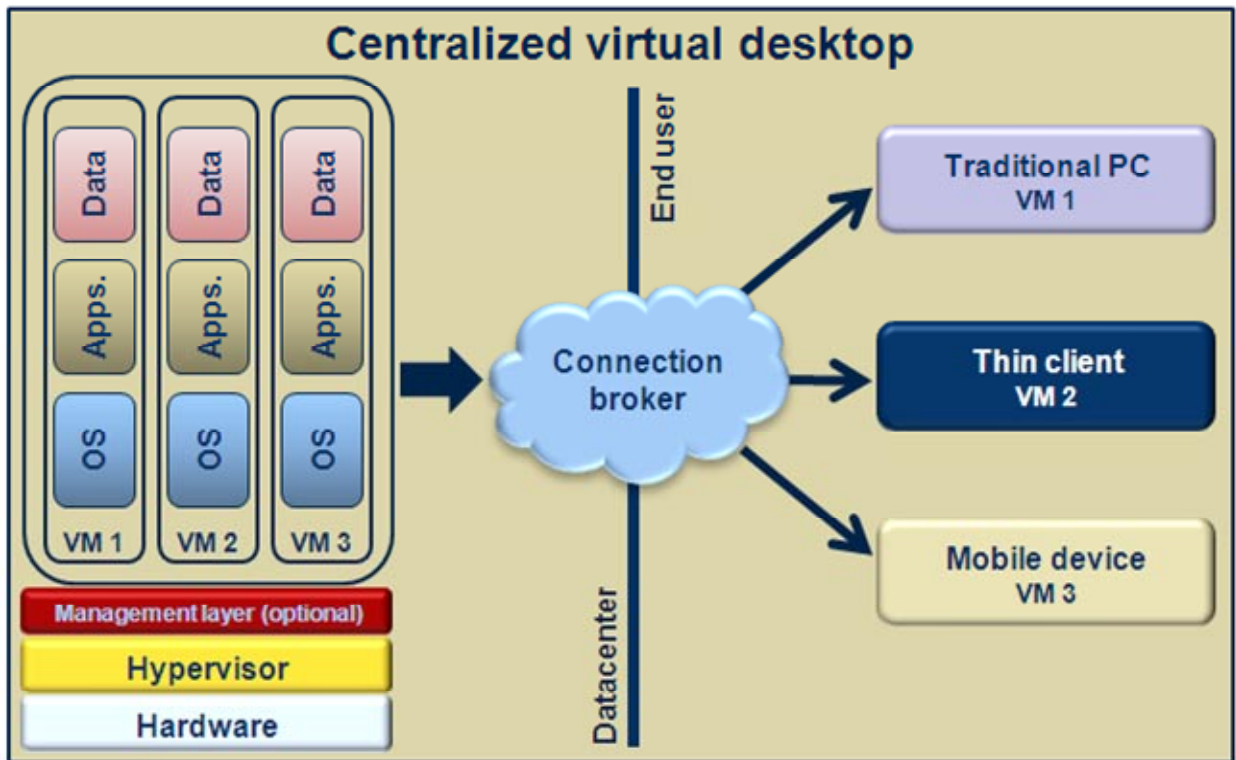
Source: IDC, 2011

The end users may access the virtual desktop from a zero- or thin-client machine that has zero (or minimal) local storage, processing power, or software, or they may open a virtual window on a traditional PC. In the latter scenario, the PC acts like a thin client when interacting with the virtual environment, but the end user also has the ability to use the machine as a regular PC. When all applications reside on a central machine, the result is a reduction in application sprawl. The school district IT managers can monitor and track the various applications needed for different schools, grade levels, and administrative functions from a central server, which allows for more control and visibility.

Budget-Driven Computing Decisions: The Advantages of Desktop Virtualization

Today's economy has made for very tight budget times for many school districts. They are under great pressure to do more with less. Virtualized desktops have proven to be one arena where costs can be cut for the long term, without impacting the levels of service provided to end users. Some organizations have found that they can keep older PCs in operation an extra year or two by taking the computing pressure off

individual PCs and moving it to a server. Others have chosen to replace PCs with lower-cost thin-client machines in an effort to reduce maintenance issues related to those PCs. Both approaches seem effective at helping IT staffs reduce costs and overall maintenance.

For schools that have virtualized their entire environment, and not just labs, all stakeholders expressed satisfaction that students, teachers, and staffers are now able to access their desktops from multiple devices, and even different types of devices, such as PCs, tablet computers, smartphones, or machines located in schools or at home. "This is about expanding our technology and making it more available, expanding its use outside the physical limitations of our campuses and outside the limitations of the normal school day," said Michael O'Callaghan, IT director of the De Pere, Wisconsin, school district.

Another noticeable advantage of desktop virtualization is that it can give an organization a universal approach to how users access information and provide better integration of technology into the classroom. Giving every person easy access to a standardized PC desktop effectively levels the playing field on who has access to which resources. All can be controlled at the server level with a permissions-based set of tools. The result is an expansion of appropriate technologies to whichever end-user base needs the available functionality.

CASE STUDY HIGHLIGHTS

Making the case for desktop virtualization in a K–12 setting means demonstrating that the proposed solution will do two things:

1. Reduce overall costs associated with maintaining machines and services

2. Improve overall service levels and functionality for students and staff in greatly reduced time frames

The following case studies provide details on how individual K–12 school districts have addressed these two issues and how they made the decision to move toward virtualized desktops.

Chino Valley Unified School District, California

The Chino Valley Unified School District (Chino Valley) is a large school district with 36,000 students enrolled in 22 elementary schools, six junior high schools, four high schools, and three alternative and adult schools. The district employs 3,000 staff members, and schools are located throughout the area across 30 buildings.

"My main challenge here at the district is that we don't have money. So I need to find ways to minimize costs as much as possible," said Network Specialist Georges Khairallah, echoing a common issue for many school districts.

Chino Valley's virtualization program started in 2006 and was a case of "the technology sold itself," according to Khairallah. At that time, Chino Valley had no enterprisewide plans for virtualization and little existing virtualization in place. Khairallah started small with server virtualization, using VMware Server as a proof of concept. Because its newest servers were five to six years old, Chino Valley began slowly replacing servers and consolidating multiple servers at each of the sites to one piece of hardware. When this ad hoc approach became unwieldy to manage, with multiple hosts that were not centrally managed, Chino Valley involved VMware and its ESX product. Khairallah pitched full-force server virtualization with VMware as he had demonstrated significant cost savings.

Desktop virtualization began in 2009, and Chino Valley has achieved about 10% virtualization. At this point, three different deployments of VMware View are in operation. The first deployment has an entire school 100% on View for all its staff and labs. The second deployment includes four schools running View environments for their computer labs. The third deployment involved removing support for and depreciating Citrix Presentation Server 4.0 for the districtwide Student Information System (SIS) called Aeries. The SIS is now running on virtualized machines on View, and SIS users access the application via desktops dedicated to this application.

Chino Valley decided to go with VMware from a cost and performance standpoint. VMware was best able to support rich multimedia applications in the most affordable manner. Chino Valley would have more schools virtualized, but budget for storage is a limiting factor.

At this point in its desktop virtualization journey, Chino Valley has gone from 50 datacenter servers to eight, which includes running its SIS ERP system for 300 desktops. The district has reduced desktop costs from $1,100 per machine to $550 (for those desktops that are thick clients and enabled to run the SIS software using the VMware View Client) and $250 per machine for thin-client PCs used in the school labs (including license and hardware costs). Energy consumption has declined to 60% of its original usage.

VMware View has also greatly improved the efficiency and productivity of the staff. As Khairallah pointed out, "With VMware there is a lot of cost savings that people overlook. One of the biggest things that I can say about VMware, and it's just flabbergasting, is that it used to take two technicians three to four days to set up a lab of 40 thick machines, and now it takes one technician three hours. Software upgrades or new installations can be pushed out in two hours, as opposed to eight hours for a lab of 100 machines."

Oak Hills School District, Ohio

The Oak Hills School District (Oak Hills) serves a total of 8,200 students in nine schools. The district has implemented VMware desktop virtualization in its high school, which has 2,900 students and 150 staff members and is one of the largest high schools in Ohio.

The idea for desktop virtualization was a result of two separate projects the community was addressing: a state-required etechnology plan and a strategic plan for the high school PC replacement cycle. In both areas, the community realized that it wanted to foster learning anytime, anywhere and not just during school hours, allowing access to tools that were owned by the district and those that weren't. Parents and students wanted access to learning applications from their own devices and the ability to bring their own devices to school.

Although wireless and mobile laptop carts were used in classrooms, the high school was also asked to provide access to nonschool devices, which would require an upgrade of its infrastructure on a limited budget. The IT team knew that it didn't have the resources to install software on the students' computers or provide support to the students' devices. Virtualization offered IT the ability to provide the students with access to software from any device, without additional support or implementation costs.

"We had to do more with less. In a conversation with one of our regional partners, they mentioned VMware. And as we looked at that, we moved toward a deeper appreciation that virtualization was a piece of the puzzle," said Michael Cooper, technology coordinator for the district.

Oak Hills discussed the solution and weighed the options with its implementation partner, Champion Solutions, and its VMware representative. Champion Solutions then came in to help set up Oak Hills and train the staff. Oak Hills made the final decision in early May 2010 to go forward with desktop virtualization, and it was up and ready to go in August for the start of school.

Beyond allowing access for students from any device and location, virtualization also solved an issue around installing new software for teachers during the school year. Typically, schools install new software in May, which gives IT the needed time to purchase and install the software before the start of school in August. However, this can be very limiting to teachers if they discover software outside of this cycle. "The problem is that sometimes software decisions are made over the summer; so now we have to go back and reimage 1,000 computers, which is a lot of man-hours. With View, you have the same number of man-hours to install on one computer to get it set up, but then boom, it's done, and you can deliver that back out virtually to thousands of desktops in no time," recalled Cooper.

Finally, virtualization allowed Oak Hills to do more with the same budget. By switching to lower-cost thin clients, the school was able to purchase 1,000 thin clients and increase student access to machines and educational tools. Older, thick-client models were either repurposed as thin clients or redeployed to other schools that weren't yet virtualized. The district purchased Cisco UC blades and NetApp SAN to run the virtualized environment.

Savings to date are estimated at approximately $300,000. Oak Hills roughly estimates that the district will save more than that each year for the next five years. There have been fewer repair and maintenance costs for thin clients and lower electricity costs for air conditioning. In addition, there have been productivity gains in student learning and among IT staff. The school also has been able to add two sets of software during the school year, which previously would have been delayed.

"The parents have been thrilled to death with a Web site that has all of our portals that the students can get into, whether that's a learning management system or virtual desktop. And students are able to catch up on coursework and projects over school breaks and thus have been able to bring up their grades," said Sharon Blanton, director of curriculum and technology.

Cooper added, "I think all of us would agree it has more than exceeded our initial expectations."

School District of Somerset, Wisconsin

Somerset County is one of the top 5 fastest-growing counties in Wisconsin, and the School District of Somerset has been among the top 75 school districts in the country for the past several years. The district has 1,675 students and 225 faculty members located in four buildings on a 180-acre campus. There are three full-time IT staff, plus a shared program secretary.

Somerset adopted VMware View to achieve a 1:1 student-to-computer ratio for all its students. To do this, Somerset extended the life of its existing desktops and enabled students to use their own devices to have "anytime" access to school content and applications. Getting students to use their own devices was a fiscal savings for the district, but supporting the devices and ensuring a consistent learning environment for the students and staff presented a challenge.

Somerset's journey with VMware began four years ago with server virtualization. Two years ago, after successful server virtualization, the district began discussing desktop virtualization using VMware View. It started a pilot implementation in 2009 focused on a set of 35 "power users" — building and administrative staff who would be heavy users of the systems. Now Somerset is completing its second phase of the

deployment, which focuses on 5th–12th graders, and has virtualized close to 1,000 desktops.

"Part of me was saying 'Okay, we can go down the same traditional route we've been going for the last 10–15 years of buying machines and figuring out a way to deploy them,' but there is now a chance to do something different that will allow us to better handle the changes we see on the horizon," said Ryan Sicard, IT director of the district.

Somerset selected VMware after an informal RFP process that compared it with two other vendors. Somerset worked with a VMware reseller and integrator, Heartland Business Systems, which provided critical support around the implementation, and the VMware account manager and systems engineer who helped architect the solution. Somerset has made a $400,000 investment, mostly in hardware investments like HP blade infrastructure and EMC SAN storage with its fast cache technology. Sicard found that while the up-front costs are higher than those of a traditional model, the school realized many benefits right away.

Compared with a traditional hardware deployment, reusing older machines and using machines longer has enabled Somerset to save 40% overall. Service has improved with consistent access for users, which had been a major problem for years, and Sicard expects a positive ROI in two years. He has already licensed VMware ThinApp and has plans for application virtualization.

De Pere School District, Wisconsin

De Pere School District has 3,800 students and 280 teachers in six school buildings. Over the past two years, the district has lost about $900,000 in state funding. With no reductions in student enrollment, De Pere was forced to take a serious look at cutting costs and becoming more efficient.

De Pere worked with VMware to virtualize its servers in 2008, which allowed the district to move from 46 servers in racks to four virtualized servers. In 2009, the district began desktop virtualization. Michael O'Callaghan, technology director, had to obtain more buy-in for desktop virtualization (compared with server virtualization) because it was seen as something that would impact the teachers' and students' user experience. Beyond the up-front investment, the superintendent and school board were convinced when they saw the yearly maintenance costs drop from $300,000–400,000 to about $100,000–150,000 for 1,500 devices. De Pere obtained a reference for VMware from Northeast Wisconsin Technical College, and that reference, coupled with the success it experienced with server virtualization, sold it on VMware View.

At this point, De Pere is more than 70% virtualized. The district manages 1,500 desktops and laptops. One hundred percent of the 1,100 machines in carts, labs, and library media centers are virtualized for kindergarten through 12th grade. The 400 staff machines are not yet virtualized. Machines are a mix of thin-client HP laptops, Samsung zero-client monitors, and Lenovo ThinkPads or desktops that run a very skinny version of Windows and launch View. Students get a consistent desktop wherever they are, and everything is stored and backed up on the servers in the datacenter. De Pere had a three- to four-year replacement policy, but now it replaces a machine that cannot be repaired with an HP thin-client laptop running Windows XP or with a Samsung zero-client monitor that supports the PCoIP protocol.

"I think our students and our staff would tell you that the environment is more reliable and predictable and faster than a traditional desktop/laptop environment," said O'Callaghan.

De Pere invested $500,000 over two summers, which included systems integration and consulting from Paragon Development Systems, VMware licenses, its blade center, Cisco core switch upgrades, and a NetApp storage appliance. "So far, my estimate of what we'll have to spend longer term is playing out to be a conservative estimate, in other words somewhat inflated, because I built in a need to replace about 20% of my physical equipment each year, and that hasn't played out to be true. We're actually running that stuff longer than we had intended," said O'Callaghan.

The future view is for virtualization as a platform for cloud computing and further cost savings. "This is about expanding our technology and making it more available, expanding its use outside the physical limitations of our campuses and outside the limitations of the normal school day," said O'Callaghan.

"The support we've been getting from VMware has been fantastic; we've been very, very pleased. Anecdotally I think we respond more quickly and are more efficient because the desktops are basically running down in the datacenter, and there are good VMware tools to be able to manage that. As a result, I see my team focus less on hardware and more on helping teachers and students use the technology, which is huge," said O'Callaghan.

SUMMARY OF FINDINGS AND BENEFITS

After talking with multiple K–12 education institutions about why they chose to move to virtualized desktops, we detected a few clear patterns:

- In most cases, the up-front costs of the new virtualized solution were no more than those of the existing PC-based solutions that the schools were replacing. In all cases, maintenance, repair, and support costs were significantly lower.

- School districts were able to extend the life of existing PCs, often by two or more years, which resulted in significant long-term cost savings.

- Zero- and thin-client solutions are gaining ground in schools, especially for machines located in libraries, labs, and public areas. Districts with desktop virtualization have stopped buying $1,000 PCs, and they now use thin-client terminals, which sell for $250, to provide the same Windows 7 desktop experience to end users.

- Several school districts allow students and some staffers to use their own PCs and handheld devices. This further reduces the hardware investment for the districts and gives end users more flexibility.

- Many schools see an improvement in service delivery and availability with desktop virtualization. Log-in times are often reduced significantly, which is a big positive for keeping younger students engaged and leaving more time for class instruction. Also, there are fewer instances of machines being out of service or work being lost because of a broken machine.

- In an ecofriendly age, environmental benefits — such as less power consumption, slower rate of PC disposal, and reduced packaging (including software packaging that formerly was opened and installed on various PCs) — are also important gains.

Virtual desktops provide a highly flexible computing environment that is more efficient for both IT managers and end users. IT staffers can focus less on maintenance issues and more on other types of system improvements. Teachers and students can focus on teaching and learning rather than on maintaining systems and helping troubleshoot issues.

Virtualized desktops also are a significantly more efficient way to use a group's computing resources in a more secure manner because desktops are more tightly controlled when they reside on a central server. In addition, data is much less likely to be lost or stolen because it no longer resides on multiple PCs located in schools (or taken home). This supports a consistent student learning environment, leading to performance improvements, thanks to system reliability. For the first time, staff, teachers, and end users can count on a consistent and reliable look and feel to their desktops and applications, regardless of the age of the devices being used.

LESSONS LEARNED

In our interviews, common comments were made about the lessons learned by these school districts. These words of advice are summarized in Table 1 and hopefully will help other schools in their VMware View virtual desktop implementations (see Table 1).

TABLE 1

Lessons Learned in K–12 School Districts When Implementing Desktop Virtualization

Lesson	Comment
Plan for the up-front investment that virtualization requires.	Depending on school situation — tax base, performance, and economic status of students — different schools, even within one school district, can have different levels of monies coming in. This may present a challenge to districtwide investments to desktop virtualization.
Get help in architecting, implementing, and scaling.	"Let go of your pride, and let somebody help you initially." (Chino Valley) "Getting good outside help to jump-start your team's ability to support the environment — it was a huge thing for us." (Somerset) This was a repeated mantra. For environments with 100 or 200 workstations or more, get some advice before you move forward.
Take a phased approach and plan, plan, plan.	Do a proof of concept, conduct a pilot, or take a measured and phased approach. Take time to articulate what your measurable goals and objectives are.
Plan for storage.	The storage design of VDI architecture is key. Schools can save a lot with centralized storage. A SAN costs anywhere from $18,000 to $26,000 and can get expensive if there is one per site. Look into your storage needs and enterprisewide storage.
Desktop virtualization can be a different sell compared with server virtualization.	Most IT managers did not have to ask for more money for desktop virtualization, but it is different for the traditional model because expenses are spread out. Virtualization has more up-front costs. Also, while server virtualization is backend, desktop virtualization may be viewed as affecting students and teachers more directly, which can lead to more caution on the part of school boards or administration.
	Desktop virtualization has more up-front costs than server virtualization because it involves workstations, aging machines, and storage. The costs can look different than thick-client costs, which are spread out in smaller increments according to refresh cycles. "But if you compare that to all the little factors, like your man-hours, electricity, and all that, you'll end up on top all the time." (Chino Valley)
Don't shortcut the technical specs, the hardware, or the software.	In your initial implementation, don't shortchange on the technical specs, whether it's hardware or View licenses. You can always scale back or adjust if needed in a subsequent phase.
	"We did a 10 Gig blade on our Cisco core switch to handle some of the IOPS in the datacenter. If you think you might need to do that, do that up front, don't shortchange it because the downside of poor user experience is poor user acceptance, and that is huge for the strategy. That is why we didn't shortchange anything in the implementation." (De Pere)
Communicate with teachers and provide training prior to launch.	Students will adapt quickly, but teachers can worry about the unknown, especially when it comes to technology and implementations that might be timed right before, or during, school sessions.
	Small details, like having teachers help students create their own Microsoft template and style sheets, will ease the transition.

TABLE 1

Lessons Learned in K–12 School Districts When Implementing Desktop Virtualization

Lesson	Comment
Calculate ROI.	Educational organizations that are considering desktop virtualization should do their own return-on-investment analysis before taking the plunge. They can develop their own cost/benefit analysis tools, use the tool offered by VMware, or look for third-party tools. Luckily, this enterprisewide solution has advantages that are easy to measure.
	Price points per seat are available for the software. Servers do not require any special configurations, so commodity servers can be used. The sizes and performance levels of those servers are dictated by the number of end users being served. End-user client costs are predictable because prices are readily available for thin-client machines, or people can use existing PCs if they prefer.
Account for less measurable savings.	Less electricity use, reduced air conditioning costs, more productive use of IT staff time, doing more with the same staffing levels, and the anywhere/anytime education access for students are all important factors that contribute to the cost/benefit analysis of desktop virtualization.

Source: IDC Government Insights, 2011

FUTURE OUTLOOK

Desktop virtualization has a bright future in K–12 schools. It is a strategic investment whose time has come; schools can provide a more reliable, scalable, faster, cheaper, and consistent experience for students, teachers, and administrative staff that is easier to maintain.

While the virtualized desktop approach may not be the best match for every school or district, it is something every organization should at least consider and investigate. The solution is increasingly flexible and fast, and the majority of school districts that have taken the plunge are happy with the result. Desktop virtualization will grow in its ability to support the necessary media-rich applications prevalent in schools today, and it paves the way for adoption of application virtualization and cloud computing. As cloud computing evolves, it's highly likely that many schools will get some of their desktop services from the cloud.

School districts using desktop virtualization plan to keep expanding their services to students and teachers — from document sharing capabilities, to curriculum for math and English via Web applications, to a view of learning that truly can be supported outside of the classroom. The ability of desktop virtualization to enable schools to continually expand services, offer a consistent user experience across

multiple devices, and ultimately meet challenging educational goals is a true achievement, particularly in the face of budget restrictions. For these reasons, it is clear that for K–12 schools, desktop virtualization is a technology whose time has come.

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